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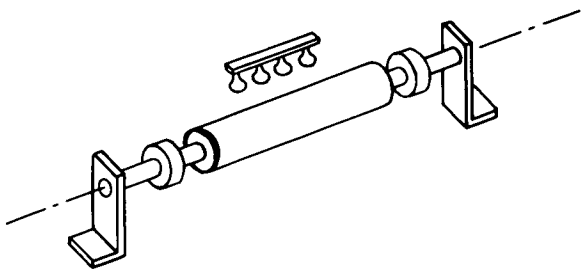
Metal Tube Used as Solar Engine

A thin-walled metal tube is the working medium for a thermal engine which is structurally simple when compared with other engines that are based on the expansion of gases, fluids, or metals.



The diagram is a simplified sketch of the basic elements of the solar engine. The ends of the metal tube are fastened to axles which are supported on bearings so that the tube can rotate about its long axis while subjected to an invariant bending moment that stresses it along the longitudinal axis of rotation. The stressing causes the top of the tube to be subjected to compression while the bottom is under tension. The tube is positioned so that radiant energy from a source is concentrated largely on the top; heat absorbed leads to an expansion of the metal, which unbalances internal forces and generates a rotational moment in the tube.

The thin-walled cylindrical tube is formed of metal to provide a single-phase-solid working body and is coated with a thin layer of flat-black paint to increase the absorptivity and emissivity of radiant energy. External masses in the form of annular weights are coaxially mounted on the shafts at the greatest distances from the support bearings; the weights establish uniform longitudinal bending moments which continuously stress the tube so that its uppermost longitudinal portion is compressed and its lower portion is under tension. Since the stressing forces applied by the weights are fixed in direction because of gravity, the bending stresses within the tube are independent of rotation.

As suggested in the diagram, the tube is positioned so that heat rays from a source of radiation fall upon the portion of the tube which is under compression. The source is positioned slightly off the vertical plane (by about 5°) so that the engine will be self-starting. No heat is applied to the bottom of the tube and, preferably, conditions are arranged so that heat is readily removed therefrom by radiation or convection.

A solar engine using a solid as a working medium has a low thermal efficiency when compared with engines using gases or liquids, but it is especially useful for the direct conversion of solar energy into mechanical motion when design simplicity is of primary importance.

References:

1. Beam, R., and Jedlicka, J.: A Solar Engine Using the Thermal Expansion of Metals. Solar Energy, vol. 15, p. 133, 1973.
2. Jedlicka, J.: Solid State Solar Engine. The Physics Teacher, vol. 10, p. 475, 1972.

(continued overleaf)

Note:

No additional documentation is available. Specific questions, however, may be directed to:

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Patent status:

Inquiries concerning rights for the commercial use of this invention should be addressed to:

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